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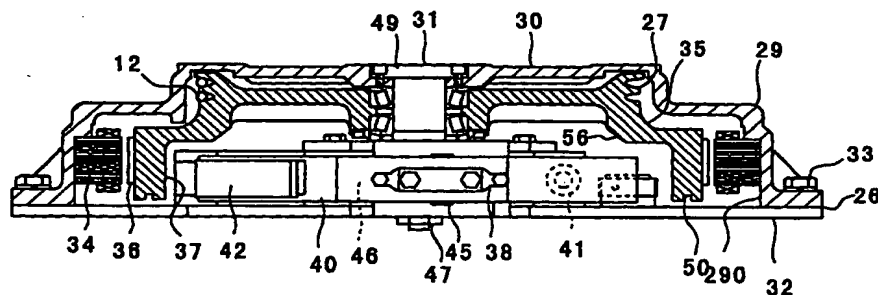
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(57) In a hoisting machine of a elevator system, one side of a ring-shaped recessed base member is formed open. A shaft originates from the bottom portion of the base member at right angle within the base member. A support plate is provided so as to extend across the opening of the base member, and a brake is mounted on the support plate. A stator winding is provided along the interior surface of the base member in the vicinity of the opening. A ring-shaped recessed rotator is rotatably supported by a shaft within the base member, and a driving sheave is formed in the outer periphery of the rotator in the vicinity of the bottom portion. Further, an

armature is provided on the outer periphery of the rotator defining the open side thereof. A brake surface is formed along the internal peripheral surface of the rotator on the opposite side of the armature. The configuration prevents adherence of rope oil to the brake and the brake surface, which would otherwise be caused when the rope oil splashes from the main cable. The hoisting machine is provided at the ceiling in a hoistway and is capable of readily maintaining stable braking action of the hoisting machine.

**Fig. 5****EP 1 078 876 A2**

## Description

### Background of the Invention

#### Field of the Invention

[0001] The present invention relates to an elevator system, having an improved hoisting machine, in which a main cable connecting a car with a counterweight is driven by a hoisting machine disposed within a hoistway.

#### Background Art

[0002] FIGS. 16 through 18 show a conventional elevator system described in, for example, Japanese Patent Laid-Open No. 139321/1998. FIG. 16 is a perspective view conceptually showing the elevator system; FIG. 17 is a transverse plan view showing the principal section of the elevator system shown in FIG. 16; and FIG. 18 is a longitudinal cross sectional view of a hoisting machine shown in FIG. 16. In these drawings, reference numeral 1 designates a hoistway; 2 designates a car which moves vertically along a predetermined path within the hoistway 1; 3 designates a counterweight which moves vertically along another path within the hoistway 1; and 4 designates a hoisting machine. By means of a support member 5 disposed in an upper position within the hoistway 1, the hoisting machine 4 is mounted on the ceiling of the hoistway 1. A driving sheave 6, whose rotor axis is oriented vertically, is attached to the hoisting machine 4. Throughout the specification, the expressions "up," "down," "above," "below," "right," "left," "laterally," "longitudinally," and like expressions are used herein to define the positions of constituent elements of the elevator system when the elevator system is positioned in an orientation in which it is intended to be used.

[0003] Reference numeral 7 designates a first car pulley provided along one side of the lower surface of the car 2; 8 designates a second car pulley provided along another side of the lower surface of the car 2; 9 designates a counterweight pulley provided on top of the counterweight 3; 10 designates a car-side pulley whose rotor axis is oriented horizontally and which is provided in an upper location within the hoistway 1 so as to overlap the second pulley 8 when viewed from the top; and 11 designates a counterweight-side pulley whose rotor axis is oriented horizontally and which is provided in an upper location within the hoistway 1 so as to overlap one side of the counterweight pulley 9 when viewed from the top.

[0004] Reference numeral 12 designates a main cable. One end of the main cable 12 is fixed at an upper location within the hoistway 1 by means of a first cable anchor 13 which is mounted on the ceiling and is located so as to overlap the first pulley 7 when viewed from the top. The other end of the main cable 12 is fixed

at another upper location within the hoistway 1 by means of a second cable anchor 14 which is mounted on the ceiling and is located so as to overlap the other side of the counterweight pulley 9 when viewed from the top. The main cable 12 extends from its one end connected to the first cable anchor 13 to the other end connected to the second cable anchor 14, by way of the first car pulley 7, the second car pulley 8, the car-side pulley 10, the driving sheave 6, the counterweight-side pulley 11, and the counterweight pulley 9, in the sequence given.

[0005] Reference numeral 15 designates a frame of the hoisting machine 4; 16 designates a rotor shaft which is rotatably supported by the frame 15 in the vertical direction; and 17 designates a rotator. The driving sheave 6 is formed on the outer periphery of a shaft-like downwardly-protruding portion of the rotator 17. A brake surface 18 is formed along the interior surface of a lower part of a flange portion of the rotator, which surface opposes the driving sheave 6. An armature 19 is formed on the exterior surface of an upper part of the flange portion; that is, the exterior surface of the portion of the flange at an opposite direction of the driving sheave 6. Reference numeral 20 designates a stator winding provided on the inner surface of the frame 15 so as to oppose the armature 19, and 21 designates a brake supported by the frame 15. A brake piece 22 is attached to the brake 21 so as to oppose the brake surface 18.

[0006] The conventional elevator system is constructed as described above. The hoisting machine 4 is driven, to thereby rotate the driving sheave 6 and move the car 2 and the counterweight 3 in opposite directions by way of the main cable 12. The hoisting machine 4 is disposed at an upper location within the hoistway 1. A machinery room, which would otherwise be independently provided in a position above the hoistway 1, is obviated, thus reducing the space occupied by the elevator system within an unillustrated building.

[0007] In the conventional elevator system as described above, the brake 21 supported by the frame 15 is disposed around the outer periphery of the driving sheave 6 within the frame 15 of the hoisting machine 4. Such a layout encounters problems of rope oil splashing from the main cable 12 wound around the driving sheave 6 and the thus-splashed rope oil adhering to the brake 21. The brake 21 is disposed in proximity to the driving sheave 6, thus making inspection of the brake 21 difficult or impairing the reliability of function of the brake 21.

#### Summary of the Invention

[0008] The present invention has been conceived to solve these drawbacks of the conventional elevator system and is aimed at providing an elevator system capable of readily maintaining stable braking action of a hoisting machine disposed within a hoistway.

[0009] According to one aspect of the present

invention, a hoisting machine of an elevator system comprises a cup-shape recessed base member having one open side. A stator winding is provided along the interior surface of the base member in the vicinity of the opening. A support plates is provided so as to extend across the opening of the base member and to be attached to the edge of the opening. A shaft is provided to bridge the bottom portion of the base member and the support plate. A cup-shape recessed rotator is provided whose one end is open. The bottom of the rotator is rotatably supported by the shaft. A driving sheave is formed on the outer periphery of the rotator in the vicinity of the bottom thereof. An armature is provided on the outer periphery of the rotator defining the open side thereof so as to oppose the stator winding. A brake surface is formed along the internal peripheral surface of the rotator on the oppose side of the armature. A brake is mounted on the support plate and exerts braking force toward the brake surface. Thus, the drive sheave and the brake are isolated each other.

[0010] According to another aspect of the present invention, an elevator system comprises a car which moves vertically along a predetermined path within a hoistway. A counterweight is provided in a clearance defined between the interior wall of the hoistway and the car. A pair of turning pulleys are provided whose rotation axes are oriented horizontally and which are provided on the upper end of the hoistway. One of the turning pulleys is provided so as to associate with the car, and the other is provided so as to associate with the counterweight. A hoisting machine is mounted on the upper end of the hoistway so as to correspond to the vicinity of a side surface of the car opposite the door, and the hoisting machine has a driving sheave provided thereon and whose rotor axis is oriented vertically. Further, a main cable is provided whose one end is connected to a predetermined location on the hoistway by way of the car pulley and whose other end is connected to another location on the hoistway by way of the counterweight pulley, and main cable extends vertically to a pair of turning pulleys and extends horizontally to the driving sheave.

[0011] Other and further objects, features and advantages of the invention will appear more fully from the following description.

### Brief Description of the Drawings

[0012]

FIGS. 1 through 10 are drawings illustrating an example elevator system according to a first embodiment of the present invention;

FIG. 1 is a left side view conceptually showing an elevator system according to the first embodiment; FIG. 2 is a rear side view of the elevator system shown in FIG. 1;

FIG. 3 is a transverse cross section of the principal

element of the elevator system shown in FIG. 1; FIG. 4 is a perspective view of the elevator system; FIG. 5 is a longitudinal enlarged cross-sectional view of a hoisting machine shown in FIG. 1 through FIG. 6 is a bottom view of the hoisting machine shown in FIG. 5;

FIG. 7 is a plan view showing a brake of the hoisting machine shown in FIG. 5;

FIG. 8 is another longitudinal enlarged cross-sectional view of the hoisting machine when the brake is removed therefrom;

FIG. 9 is an enlarged perspective view of the hoisting machine;

FIG. 10 is an enlarged perspective view of a main cable latch shown in FIG. 8;

FIGS. 11 and 12 show another example elevator system according to a second embodiment of the present invention;

FIG. 11 is a bottom view of the hoisting machine corresponding to FIG. 6 of the first embodiment;

FIG. 12 is a side view showing the hoisting machine when a brake section of the hoisting machine is opened;

FIGS. 13 and 14 show an example elevator system according to a third embodiment of the present invention;

FIG. 13 is a conceptual side view of an elevator system according to the present embodiment;

FIG. 14 is a transverse cross section of the principal section of the elevator system shown in FIG. 13;

FIGS. 16 through 18 show a conventional elevator system;

FIG. 16 is a perspective view conceptually showing the elevator system;

FIG. 17 is a transverse plan view showing the principal section of the elevator system shown in FIG. 16; and

FIG. 18 is a longitudinal cross sectional view of a hoisting machine shown in FIG. 16.

### Detailed Description of the Preferred Embodiments

#### First Embodiment

[0013] FIGS. 1 through 10 are drawings illustrating an example elevator system according to a first embodiment of the present invention. FIG. 1 is a left side view conceptually showing an elevator system according to the first embodiment; FIG. 2 is a rear side view of the elevator system shown in FIG. 1; FIG. 3 is a transverse cross section of the principal element of the elevator system shown in FIG. 1; FIG. 4 is a perspective view of the elevator system; FIG. 5 is a longitudinal enlarged cross-sectional view of a hoisting machine shown in FIG. 1 through 4; FIG. 6 is a bottom view of the hoisting machine shown in FIG. 5; FIG. 7 is a plan view showing a brake of the hoisting machine shown in FIG. 5; FIG. 8 is another longitudinal enlarged cross-sectional view of

the hoisting machine when the brake is removed therefrom; FIG. 9 is an enlarged perspective view of the hoisting machine; and FIG. 10 is an enlarged perspective view of a main cable latch shown in FIG. 8.

**[0014]** In the drawings, reference numeral 1 designates a hoistway; and 2 designates a car which moves vertically along a predetermined path within the hoistway 1. A door 23 is provided in the car 2, and an upper beam 24 is provided on top of the car 2. An indented surface 25 is formed by means of provision of the upper beam 24 on the upper surface of the ceiling of the car 2. Reference numeral 3 designates a counterweight provided in a clearance which is defined between the interior wall surface of the hoistway 1 and the car 2, when viewed from the top.

**[0015]** Reference numeral 26 designates a hoisting machine, which will be described in detail later. The hoisting machine 26 is fixedly secured to the ceiling of the hoistway 1 at an opposite direction of the door 23 of the car 2; that is, a portion of the indented surface 25 close to the side of the car 2 opposite the door 23. A driving sheave 27 whose rotor axis is oriented vertically is mounted on top of the hoisting machine 26.

**[0016]** Reference numeral 7 designates a first car pulley provided along one side of the lower surface of the car 2; 8 designates a second car pulley provided along another side of the lower surface of the car 2; 9 designates a counterweight pulley provided on top of the counterweight 3; and 10 designates a car-side turning pulley of the car 2. The car-side turning pulley 10 is disposed within a space between the interior wall surface of the hoistway 1 and the car 2, when viewed from the top. The rotation axis of the car-side turning pulley 10 is oriented horizontally, and the car-side turning pulley 10 is disposed at an upper location within the hoistway 1 so as to overlap one side of the second pulley 8, when viewed from the top.

**[0017]** Reference numeral 11 designates a counterweight-side turning pulley provided in a clearance defined between the interior wall surface of the hoistway 1 and the car 2, when viewed from the top. The rotation axis of the counterweight-side turning pulley 11 is oriented horizontally, and the counterweight-side turning pulley 11 is disposed at an upper location within the hoistway 1 so as to overlap the counterweight pulley 9, when viewed from the top. Reference numeral 28 designates shock absorbers disposed on the bottom of the hoistway 1; one being disposed so as to receive the car 2, and the other being disposed so as to receive the counterweight 3.

**[0018]** Reference numeral 12 designates a main cable. One end of the main cable 12 is fixed at an upper location within the hoistway 1 by means of a first cable anchor 13 which is mounted on the ceiling and is located so as to overlap the first pulley 7 when viewed from the top. The other end of the main cable 12 is fixed at another upper location within the hoistway 1 by means of a second cable anchor 14 which is mounted

on the ceiling and is located so as to overlap the other side of the counterweight pulley 9 when viewed from the top. The main cable 12 extends from its one end connected to the first cable anchor 13 to the other end connected to the second cable anchor 14, by way of the first car pulley 7, the second car pulley 8, the car-side pulley 10, the driving sheave 27, and the counterweight-side turning pulley 11, in the sequence given.

**[0019]** Reference numeral 29 designates a cup-shape recessed base member or a ring-shaped recessed base member of the hoisting machine 26 having one side open. An open edge 290, a bottom portion 30, and a cable exit 48 for the cable 12 are formed in the base member 29. Reference numeral 31 designates a shaft which originates from the inner surface of the bottom portion 30 of the base member 29 at right angles by way of a flange 49 of the shaft 31 within the base member 29. Reference numeral 32 designates a support plate whose longitudinal portion extends across the opening of the base member 29. Either end of the support plate 32 is located at the open edge 290 and is fastened to the base member 29 by means of joints 33, each joint being formed from a bolt penetrating through the open edge 290 and screwed into the support plate 32.

**[0020]** Reference numeral 34 designates a stator winding provided along the interior surface of the base member 29 in the vicinity of the open edge 290. Reference numeral 35 designates a cup-shape recessed rotator or a ring-shaped recessed rotator whose one end is open. The bottom portion of the rotator 35 is rotatably supported by the shaft 31, and the driving sheave 27 is formed on the outer periphery of the upper cylindrical portion of the rotator 35 in the vicinity of the bottom portion 30. Further, an armature 36 is provided on the outer periphery of a flange portion of the rotator 35 defining the open side thereof, so as to oppose the stator winding 34. A brake surface 37 is formed along the internal peripheral surface of the flange portion of the rotator 35 on the opposite side of the armature 36.

**[0021]** Reference numeral 38 designates a brake which is mounted on the support plate 32 and disposed within the rotator 35 and is composed of an electromagnetic brake. The brake 38 comprises a brake arm 40; a brake spring 41; a brake piece 42 formed from a brake shoe; a spherical seat 43; a retainer 44; a joint pin 45; and an electromagnet mechanism 46. The brake arm 40 is at one end thereof connected to the support plate 32 way of a support pin 39. Each end of the brake spring 41 is connected to the support plate 32 as well as to the pivotal end of the brake arm 40. The brake piece 42 is provided close to the support pin 39 of the brake arm 40 so as to oppose the brake surface 37. The retainer 44 is primarily formed from a screw rod inserted into the brake arm 40 and retains the brake piece 42 on the brake arm 40 via the spherical seat 43. The electromagnet mechanism 46 is provided on the support plate 32 and is joined to a longitudinal intermediate position of

the brake arm 40 by means of the joint pin 45.

[0022] Reference numeral 47 designates a joint formed from a nut for joining the support plate 32 to the shaft 31. As mentioned previously, the brake 38 comprises the brake arm 40, the brake spring 41, the brake piece 42, and the electromagnet mechanism 46. Two brakes 38 are provided symmetrically with respect to the shaft 31 serving as the center.

[0023] Reference numeral 50 designates an oil thrower groove formed in the end surface of the open edge of the rotator 35; and 51 designates inspection holes formed so as to penetrate through the base member 29. The inspection holes 51 are provided so as to oppose a rim surface of the drive sheave 27 and so as to be spaced apart from each other with respect to the circumferential direction of the rim surface of the drive sheave 27.

[0024] Reference numeral 52 designates main cable latches to be fitted into the respective inspection holes 51. A joint section 53 is formed in one side of the main cable latch 52, and the main cable latch 52 is fastened to the edge of the inspection hole 51 by means of mount screws 54. The other side portion of the main cable latch 52 is formed into an opposing surface 55, and the opposing surface 55 is disposed so as to oppose the main cable 12 wound around the drive sheave 27 with a narrow clearance formed therebetween.

[0025] Reference numeral 56 designates an isolator formed from a portion of the rotator 35. The isolator 56 isolates both the brake 38 located within the rotator 35 and the brake surface 37 formed along the interior surface of the flange portion of the rotator 35, from the drive sheave 27 formed on the outer peripheral surface of the rotator 35 in the vicinity of the bottom portion 30.

[0026] In the elevator system having the foregoing construction, the hoisting machine 26 is driven, to thereby rotate the drive sheave 27, and move the car 2 and the counterweight 3 in opposite directions by way of the main cable 12. The hoisting machine 26 is mounted on the upper end of the hoistway 1, and the drive sheave 27 is located so as to oppose the car-side turning pulley 10 and the counterweight-side turning pulley 11.

[0027] The hoisting machine 26 is fixedly secured to the ceiling of the hoistway 1 so as to oppose the portion of the car 2 disposed opposite the door 23; that is, a portion of the indented surface 25 close to the side of the car 2 opposite the door 23. The car-side turning pulley 10 and the counterweight-side turning pulley 11 are provided in a clearance defined between the interior wall surface of the hoistway 1 and the edge of the car 2.

[0028] As mentioned above, the drive sheave 27 is provided horizontally at an upper position within the hoisting machine 26, and the main cable 12 is stretched parallel to the plane of the drive sheave 27 within the vicinity of the drive sheave 27. Such a configuration enables the lower surface of the hoisting machine 26 to

be located close to the intended surface 25 of the car 2 while the main cable 12 is situated above the upper beam 24 of the car 2. Therefore, the hoisting machine 26 can be readily mounted in the hoistway 1 accommodated within the height of the top floor (not shown) of a building.

[0029] Consequently, there is obviated a necessity for making the ceiling of the hoistway 1 higher than the ceiling of the building, thus diminishing construction cost required for ensuring a space for installing the elevator system. Moreover, since the height of the building can be reduced, there may be prevented occurrence of a problem; for example, a problem of blocking sunlight from the neighboring buildings and spaces.

[0030] Further, the oil thrower groove 50 is formed in the end surface of the open edge of the rotator 35. The isolator 56 is formed from a portion of the rotator 35 and isolates both the brake 38 located at the inner side of the rotator 35 and the brake surface 37 formed along the interior surface of the flange portion of the rotator 35, from the drive sheave 27 formed in the outer surface of the rotator 35 in the vicinity of the bottom portion 30 thereof.

[0031] Accordingly, there can be prevented adherence of rope oil, dispersing from the main cable 12, to the brake 38 and the brake surface 27 provided within the rotator 35. As a result, the stable braking action of the brake 38 can be readily maintained without deteriorating the function of the brake 38.

[0032] Since the inspection holes 51 are formed so as to penetrate through the base member 29, the condition of the main cable 12 wound around the drive sheave 27 can be readily checked. By means of such a configuration, a defective condition of the main cable 12 can be readily addressed, thus enabling an improvement in the efficiency of operation, such as installation and maintenance of an elevator.

## Second Embodiment

[0033] FIGS. 11 and 12 show another example elevator system according to a second embodiment of the present invention. FIG. 11 is a bottom view of the hoisting machine corresponding to FIG. 6 of the first embodiment, and FIG. 12 is a side view showing the hoisting machine when a brake section of the hoisting machine is opened. The constituent elements of the elevator system other than those shown in FIGS. 11 and 12 are the same as those of the elevator system of the first embodiment shown in FIGS. 1 through 10. In the drawings, the elements which are the same as those shown in FIGS. 1 through 10 are assigned the same reference numerals.

[0034] Reference numeral 57 designates a support plate including a stationary section 58 and a pivotal section 59. The stationary section 58 constitutes one longitudinal end of the support plate 57, and is located near the open edge 290 of the base member 29. The station-

ary section 58 is fixedly fastened to the base member 29 by means of joints 33, each joint being formed from a bolt penetrating through the open edge 290 and screwed into the support plate 57.

[0035] The pivotal section 59 constitutes a longitudinal portion of the support plate 57 and is provided so as to extend across the opening of the base member 29. One end of the pivotal section 59 is hinged to the stationary section 58 by means of a hinge 60, and the other end of the same is located near the open edge 290 of the base member 29 and is removably fastened to the base member 29 by means of the joints 33, each joint being formed from a bolt penetrating through the open edge 290 and screwed into the support plate 57.

[0036] In the hoisting machine 26 of the elevator system having the foregoing construction, the drive sheave 27 is provided at an upper portion within the hoisting machine 26. The isolator 56 constituted by a portion of the rotator 35 isolates both the brake 38 located within the rotator 35 and the brake surface 37 formed along the interior surface of the flange of the rotator 35, from the drive sheave 27 formed in the outer peripheral surface of the rotator 35 in the vicinity of the bottom portion 30. Although a detailed explanation of the operation of the present embodiment is omitted, the elevator system of the second embodiment shown in FIGS. 11 and 12 yields the same working-effect as that yielded in the first embodiment shown in FIGS. 1 through 10.

[0037] In the second embodiment shown in FIGS. 11 and 12, the pivotal section 59 of the support plate 57 having the brake 38 mounted thereon is hinged to the stationary section 58 in the open edge 290 of the base member 29 by means of the hinge 60. The joint 47 and the joint 33 of the pivotal section 59 are released from the base member 29, and the pivotal section 59 is pivotally moved, as shown in FIG. 12. The brake 38, which is comparatively lighter than the other constituent elements, can be readily opened while involving only short-range vertical movement. A maintenance engineer performs maintenance and inspection of the brake 38 or other constituent elements. Thus, easy maintenance of the brake 38 enables an improvement in operation efficiency.

### Third Embodiment

[0038] FIGS. 13 and 14 show an example elevator system according to a third embodiment of the present invention. FIG. 13 is a conceptual side view of an elevator system according to the present embodiment, corresponding to FIG. 1 of the first embodiment, and FIG. 14 is a transverse cross section of the principal section of the elevator system shown in FIG. 13. The constituent elements of the elevator system other than those shown in FIGS. 13 and 14 are the same as those of the elevator system of the first embodiment shown in FIGS. 1 through 10 and are assigned the same reference

numerals.

[0039] Reference numeral 26 designates a hoisting machine mounted on the ceiling of the hoistway 1. Specifically, the hoisting machine 26 is obliquely secured to the ceiling of the hoistway 1 above the portion of the car 2 opposite the door 23; that is, a portion of the indented surface 25 close to the side of the car 2 opposite the door 23. The rotor axis of the driving sheave 27 is oriented obliquely relative to the vertical direction, and the edge of the base member 29 of the hoisting machine 26 is tilted downwardly above the counterweight 3.

[0040] In the elevator system having the foregoing construction, the drive sheave 27 is provided at an upper portion within the hoisting machine 26. The isolator 56 constituted by a portion of the rotator 35 isolates both the brake 38 located within the rotator 35 and the brake surface 37 formed along the interior surface of the flange of the rotator 35, from the drive sheave 27 formed in the outer peripheral surface of the rotator 35 in the vicinity of the bottom portion 30. Although a detailed explanation of the operation of the present embodiment is omitted, the elevator system of the third embodiment shown in FIGS. 13 and 14 yields the same working-effect as that yielded in the first embodiment shown in FIGS. 1 through 10.

[0041] In the embodiment shown in FIGS. 13 and 14, the hoisting machine 26 is disposed such that the edge of the hoisting machine 26 opposite the counterweight 3 is tilted downwardly. Even when a beam 1a of a building shown in FIG. 13 protrudes in a position on the ceiling of the hoistway 1 immediately above the counterweight 3, the hoisting machine 26 can be readily mounted on the ceiling while avoiding interference with the beam 1a. Consequently, there is obviated a necessity for making the ceiling of the hoistway 1 higher than the ceiling of the building, thus diminishing construction cost required for ensuring a space for installing the elevator system.

### Fourth Embodiment

[0042] FIG. 15 shows yet another example elevator system according to a fourth embodiment of the present invention. FIG. 15 is a longitudinal cross-sectional view of a hoisting machine. The constituent elements of the elevator system other than those shown in FIG. 15 are the same as those of the elevator system of the first embodiment shown in FIGS. 1 through 10 and are assigned the same reference numerals.

[0043] Reference numeral 61 designates a hoisting machine comprising a frame 62. A shaft 63 oriented vertically is supported by the frame 62, and the drive sheave 27 is formed in the outer periphery of an upper portion of the shaft 63. A rotator 64 is provided on the shaft 63. A brake surface 37 is formed along the interior surface of an upper flanged portion of the rotator 64. An armature 36 is formed on the exterior surface of a lower flanged portion of the rotator 64. A stator winding 34 is

provided within the frame 62 so as to oppose the armature 36. A brake 66 is provided within the frame 62 such that a brake piece 65 opposes the brake surface 37. An isolator 67 is attached to an upper location on a cylindrical portion of the rotator 64 so as to be positioned between the drive sheave 27 and the brake 66, to thereby cover the brake 66.

[0044] In the hoisting machine 26 of the elevator system having the foregoing construction, the drive sheave 27 is provided at an upper portion within the hoisting machine 61. The isolator 67 isolates the brake 66 located within the rotator 64 and the brake surface 37 formed along the interior surface of the flange of the rotator 64, from the drive sheave 27 formed in the outer peripheral surface of the upper cylindrical portion of the rotator 64. Although a detailed explanation of the operation of the present embodiment is omitted, the elevator system of the fourth embodiment shown in FIG. 15 yields the same working-effect as that yielded in the first embodiment shown in FIGS. 1 through 10.

[0045] The features and the advantages of the present invention as exemplified in the above embodiments may be summarized as follows.

[0046] As has been described above, in one aspect of the present invention, an elevator system has a hoisting machine which comprises a ring-shaped recessed base member having one side open. A shaft originates from the bottom portion of the base member at right angles within the base member. A support plate is provided so as to extend across the opening of the base member and to be attached to the edge of the opening. A brake is mounted on the support plate and exerts braking force in an outward direction with respect to the center of the shaft. A stator winding is provided along the interior surface of the base member in the vicinity of the opening. A ring-shaped recessed rotator is provided whose one end is open. The bottom portion of the rotator is rotatably supported by the shaft. A drive sheave is formed in the outer periphery in the vicinity of the bottom portion of the rotator. An armature is provided on the outer periphery of the rotator defining the open side of thereof so as to oppose the stator winding. A brake surface is formed along the internal peripheral surface of the rotator so as to oppose the armature. The drive sheave is isolated from the brake.

[0047] By means of the foregoing configuration, the drive sheave formed in the outer periphery in the vicinity of the bottom portion of the rotator is isolated from the brake provided within the rotator and the brake surface formed along the internal peripheral surface of the rotator. There can be prevented adherence of rope oil to the brake and the brake surface provided within the rotator, which would otherwise be caused when the rope oil splashes from the main cable. As a result, stable braking action of the brake can be readily maintained without deteriorating the function of the brake.

[0048] In another aspect, in the elevator system, an isolator formed from a portion of the rotator is provided

between the bottom and the opening of the ring-shaped recessed rotator.

[0049] By means of such isolation, the isolator formed from a portion of the rotator isolates the drive sheave formed in the outer periphery in the vicinity of the bottom portion of the rotator, from the brake provided within the rotator and the brake surface formed along the internal peripheral surface of the rotator. There can be prevented adherence of rope oil to the brake and the brake surface provided within the rotator, which would otherwise be caused when the rope oil splashes from the main cable. As a result, stable braking action of the brake can be readily maintained without deteriorating the function of the brake.

[0050] Further, in another aspect, in the elevator system, an isolator is provided separately from and attached to the rotator and is interposed between the drive sheave provided on one side of the rotator and the brake disposed on the same side so as to correspond to the drive sheave, to thereby isolate the brake from the drive sheave.

[0051] By means of such isolation, the isolator provided separately from the rotator isolates the drive sheave provided on one side of the rotator from the brake provided on the side of the rotator opposing the drive sheave so as to associate with the drive sheave. As a result, there can be prevented adherence of rope oil to the brake and the brake surface provided within the rotator, which would otherwise be caused when the rope oil splashes from the main cable. As a result, stable braking action of the brake can be readily maintained without deteriorating the function of the brake.

[0052] Further, in another aspect of the present invention, the elevator system comprises a car whose one side is formed into a door and which moves vertically along a predetermined path within a hoistway. A counterweight is provided in a clearance defined between the interior wall of the hoistway and the car. Turning pulleys are provided whose rotation axes are oriented horizontally and which are provided on the upper end of the hoistway. One of the turning pulleys is provided so as to associate with the car, and the other is provided so as to associate with the counterweight. A main cable is provided whose one end is connected to a certain location on the hoistway by way of the car, and whose other end is connected to another location on the hoistway by way of the counterweight and which extends from the car to the counterweight by way of the turning pulleys. A hoisting machine is mounted on the upper end of the hoistway so as to correspond to the vicinity of a side surface of the car opposite the door. A drive sheave is provided whose rotor axis is oriented vertically and which is provided at an upper position within the hoisting machine, wherein the portion of the main cable extending between the turning pulleys is wound around the drive sheave.

[0053] By means of the foregoing configuration, the drive sheave formed in the outer periphery in the vicinity

of the bottom portion of the rotator is isolated from the brake provided within the rotator and the brake surface formed along the internal peripheral surface of the rotator. There can be prevented adherence of rope oil to the brake and the brake surface provided within the rotator, which would otherwise be caused when the rope oil splashes from the main cable. As a result, stable braking action of the brake can be readily maintained without deteriorating the function of the brake.

**[0054]** The hoisting machine is disposed while the drive sheave is provided at an upper position within the hoisting machine. Even when the main cable is situated above an upper beam of the car, the lower surface of the hoisting machine can be located close to the intended surface of the car. Therefore, the hoisting machine can be readily mounted in the hoistway accommodated within the height of the top floor of a building. Consequently, there is obviated a necessity for making the ceiling of the hoistway 1 higher than the top floor of the building, thus diminishing construction cost required for ensuring a space for installing the elevator system.

**[0055]** Further, in another aspect, in the elevator system, the hoisting machine is provided such that the rotary axis of the drive sheave is oriented obliquely with respect to the vertical direction and such that the edge of the base member of the hoisting machine positioned so as to correspond to the counterweight is tilted downwardly.

**[0056]** Even when a beam protrudes in a position on the ceiling of the hoistway located immediately above the counterweight, the hoisting machine can be readily mounted on the ceiling while avoiding the beam. Consequently, there is obviated a necessity for making the ceiling of the hoistway higher than the top floor of the building, thus diminishing construction cost required for ensuring a space for installing the elevator system.

**[0057]** Further, in another aspect, in the elevator system, the support plate of the hoisting machine is formed from a stationary section provided on one side of the edge of the base member and a pivotal section whose one end is pivotally connected to the stationary section and whose other end is removably attached to the portion of the edge of the base member opposite the one side.

**[0058]** The base member is released from the pivotal section, to thereby pivotally move the pivotal section. The brake, which is lighter than the other constituent elements, can be readily opened while involving only short-range vertical movement. A maintenance engineer performs maintenance and inspection of the brake or other constituent elements. Thus, easy maintenance of the brake enables an improvement in operation efficiency.

**[0059]** Further, in another aspect, in the elevator system, the rotator of the hoisting machine has an oil thrower provided in the end face of the edge of the opening.

**[0060]** The isolator isolates the brake and the brake

surface from the drive sheave. Further, the oil thrower groove is formed in the end oppose of the opening of the rotator. As a result, there can be prevented adherence of rope oil to the brake, which would otherwise be caused when the rope oil splashes from the main cable. As a result, stable braking action of the brake can be readily maintained without deteriorating the function of the brake.

**[0061]** Further, in another aspect, in the elevator system, the hoisting machine is formed from a base member having inspection holes. The holes are provided opposite a rim surface of the drive sheave and spaced apart from each other in the circumferential surface of the rim of the drive sheave.

**[0062]** The condition of the main cable wound around the drive sheave can be readily checked, by way of the inspection holes, thus enabling easy addressing of a defective condition of the main cable. Consequently, the present invention yields an advantage of improving the efficiency of operation, such as installation and maintenance of an elevator.

**[0063]** Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

**[0064]** The entire disclosure of a Japanese Patent Application No. 11-240538, filed on August 26, 1999 including specification, claims, drawings and summary, on which the Convention priority of the present application is based, are incorporated herein by reference in its entirety.

## Claims

1. A hoisting machine of an elevator system, said hoisting machine (26) comprising:

a cup-shape recessed base member (29) having one open side;

a stator winding (34) provided along the interior surface of said base member (29) in the vicinity of the opening;

a support plate (32) provided so as to extend across the opening of said base member (29) and to be attached to the edge of the opening; a shaft (31) provided to bridge the bottom portion of said base member (29) and said support plate (32);

a cup-shape recessed rotator (35) whose one end is open, the bottom portion of said rotator (35) being rotatably supported by said shaft (31), a driving sheave (27) being formed on the outer periphery of said rotator (35) in the vicinity of the bottom portion thereof, an armature (36) being provided on the outer periphery of said rotator (35) defining the open side thereof



- so as to oppose said stator winding (34), and a brake surface being formed along the internal peripheral surface of said rotator (35) on the opposite side of the armature (36); and a brake (38) which is mounted on said support plate (32) and exerts braking force toward the brake surface; wherein said driving sheave (27) and said brake (38) are isolated each other.
2. The hoisting machine according to claim 1, wherein a portion of said rotator (35) extending between the bottom portion and the opening portion thereof isolates said brake (38) and said driving sheave (27) each other.
  3. The hoisting machine according to claim 1, wherein said support plate (32) of said hoisting machine (26) is formed from a stationary section provided on one side of the edge of said base member (29) and a pivotal section whose one end is pivotally connected to the stationary section and whose other end is removably attached to the portion of the edge of said base member (29) opposite the one side.
  4. The hoisting machine according to claim 1, wherein said rotator (35) of said hoisting machine (26) has an oil thrower provided in the end surface of the edge of the opening.
  5. The hoisting machine according to claim 1, wherein said base member (29) has a plurality of inspection holes, the holes being provided opposite a rim surface of said drive sheave and spaced apart from each other in the circumferential direction of the rim of said drive sheave.
  6. A hoisting machine of an elevator system, said hoisting machine (26) comprising:
    - a frame (61);
    - a stator winding (34) provided along the interior surface of said frame;
    - a shaft (63) provided vertically in said frame and supported by said frame;
    - a rotator (64) rotatably supported by said shaft (63) and having a flange portion at the lower portion thereof, a driving sheave (27) being formed on the outer periphery of the upper portion of said rotator (63), an armature (36) being provided on the outer periphery of the flange portion, a brake surface being formed along the internal peripheral surface of the flange portion;
    - a brake (66) which is mounted on said frame and exerts braking force toward the brake surface; and

an isolator (67) supported by said shaft (63) and disposed between said driving sheave (27) and said brake (66) to isolate said driving sheave (27) and said brake (66) each other.

#### 7. An elevator system comprising:

- a car (2) which moves vertically along a predetermined path within a hoistway;
  - a counterweight (3) provided in a clearance defined between the interior wall of the hoistway and said car;
  - turning pulleys (10,11) whose rotation axes are oriented horizontally and which are provided on the upper end of the hoistway, one of said turning pulleys being provided so as to associate with said car, and the other being provided so as to associate with the counterweight;
  - a hoisting machine (26) mounted on the upper end of the hoistway so as to correspond to the vicinity of a side surface of said car opposite the door, said hoisting machine (26) having a driving sheave (27) provided thereon and whose rotor axis is oriented vertically; and
  - a main cable (12) whose one end is connected to a predetermined location on the hoistway by way of said car pulley and whose other end is connected to another location on the hoistway by way of the counterweight pulley and which extends vertically to a pair of turning pulleys and which extends horizontally to said driving sheave (27).
8. The elevator system according to claim 7, wherein said hoisting machine (26) is provided such that the edge of said base member (29) of said hoisting machine (26) corresponding to the counterweight (3) is tilted downwardly and such that the rotary axis of said driving sheave (27) is oriented obliquely with respect to the vertical direction.
  9. The elevator system according to claim 7 or 8, wherein said hoisting machine (26) adopted is said hoisting machine (26) according to either of claims 1 through 6.

Fig. 1

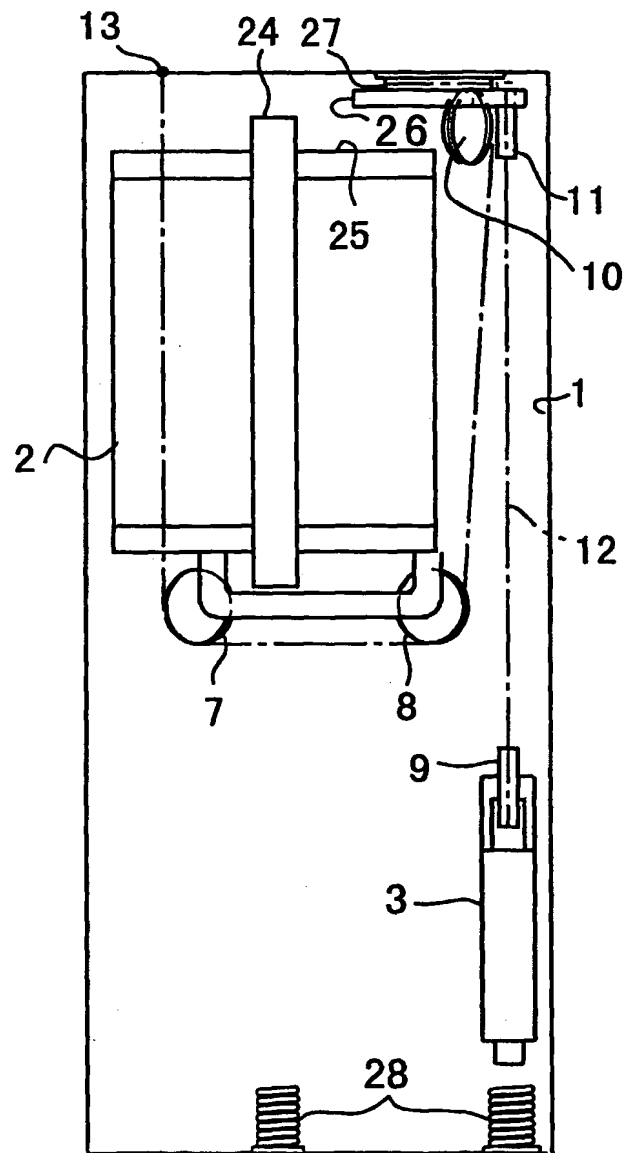
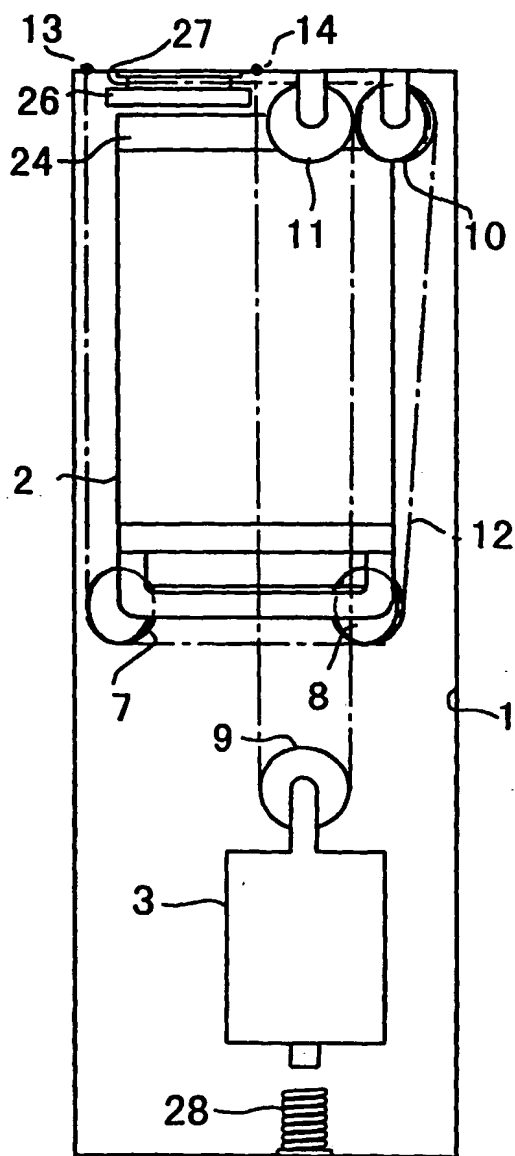


Fig. 2



*Fig. 3*

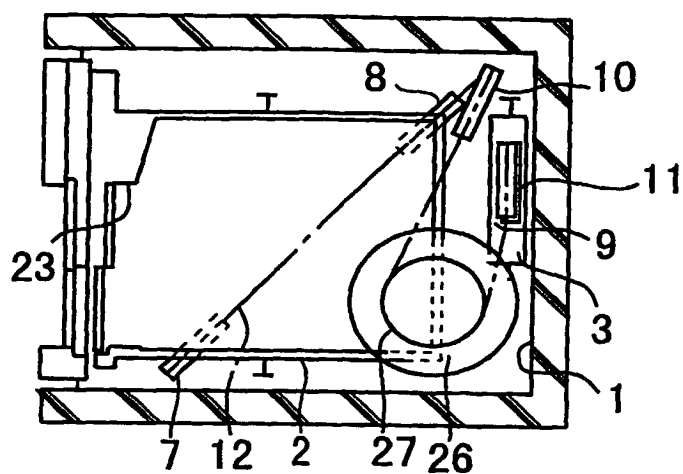


Fig. 4

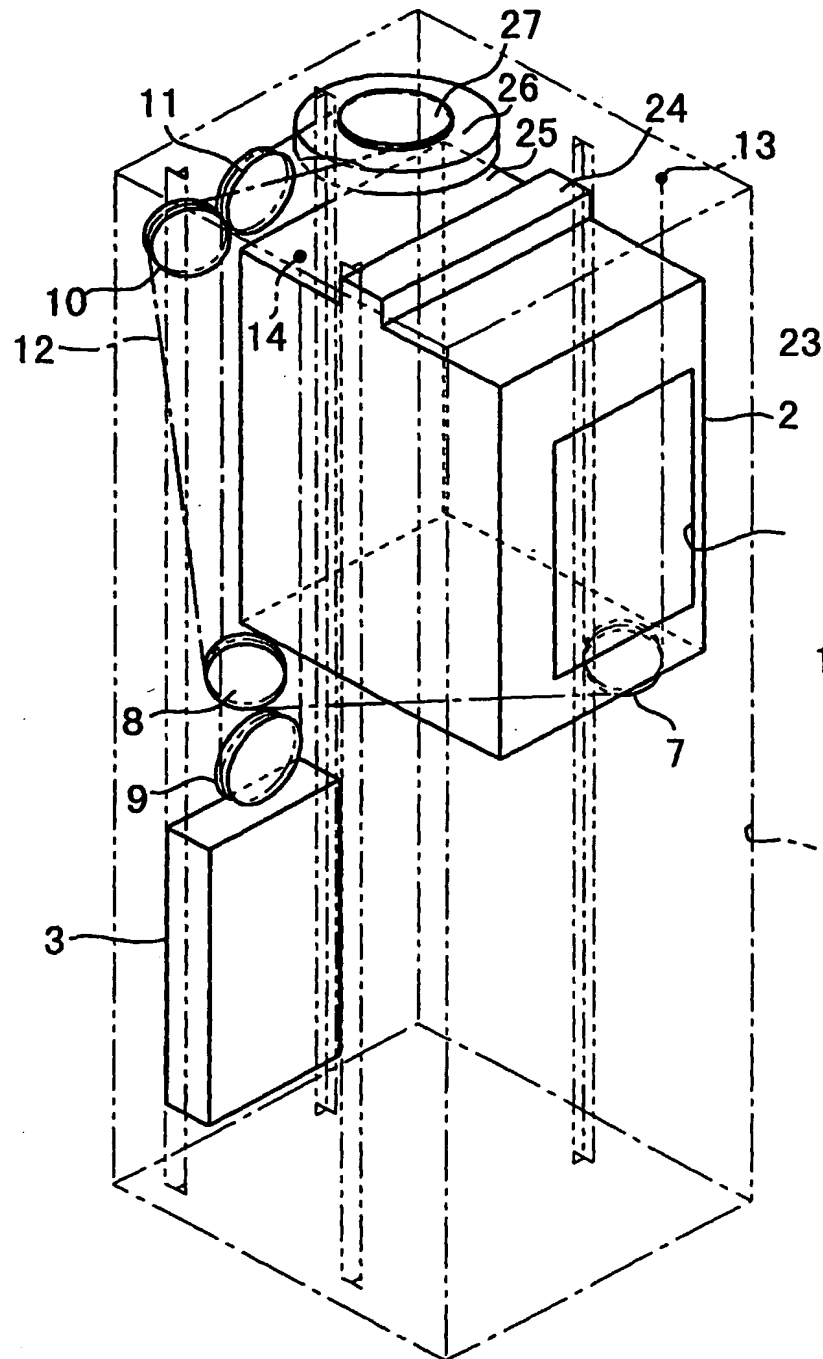
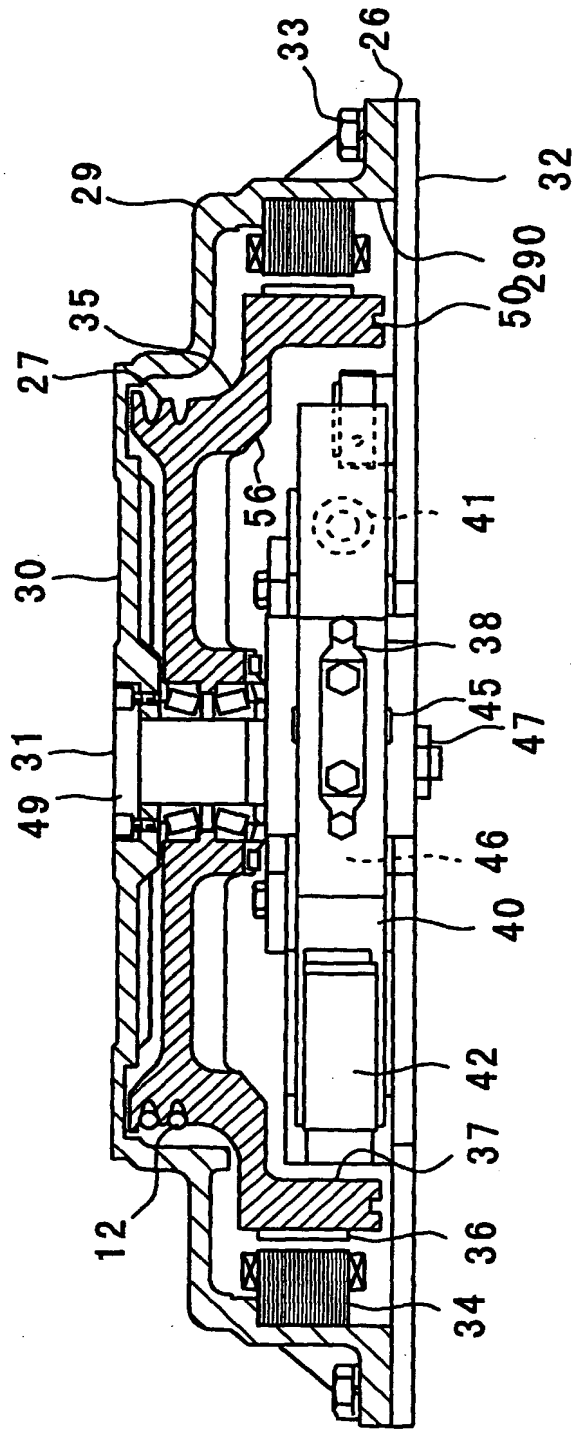


Fig. 5



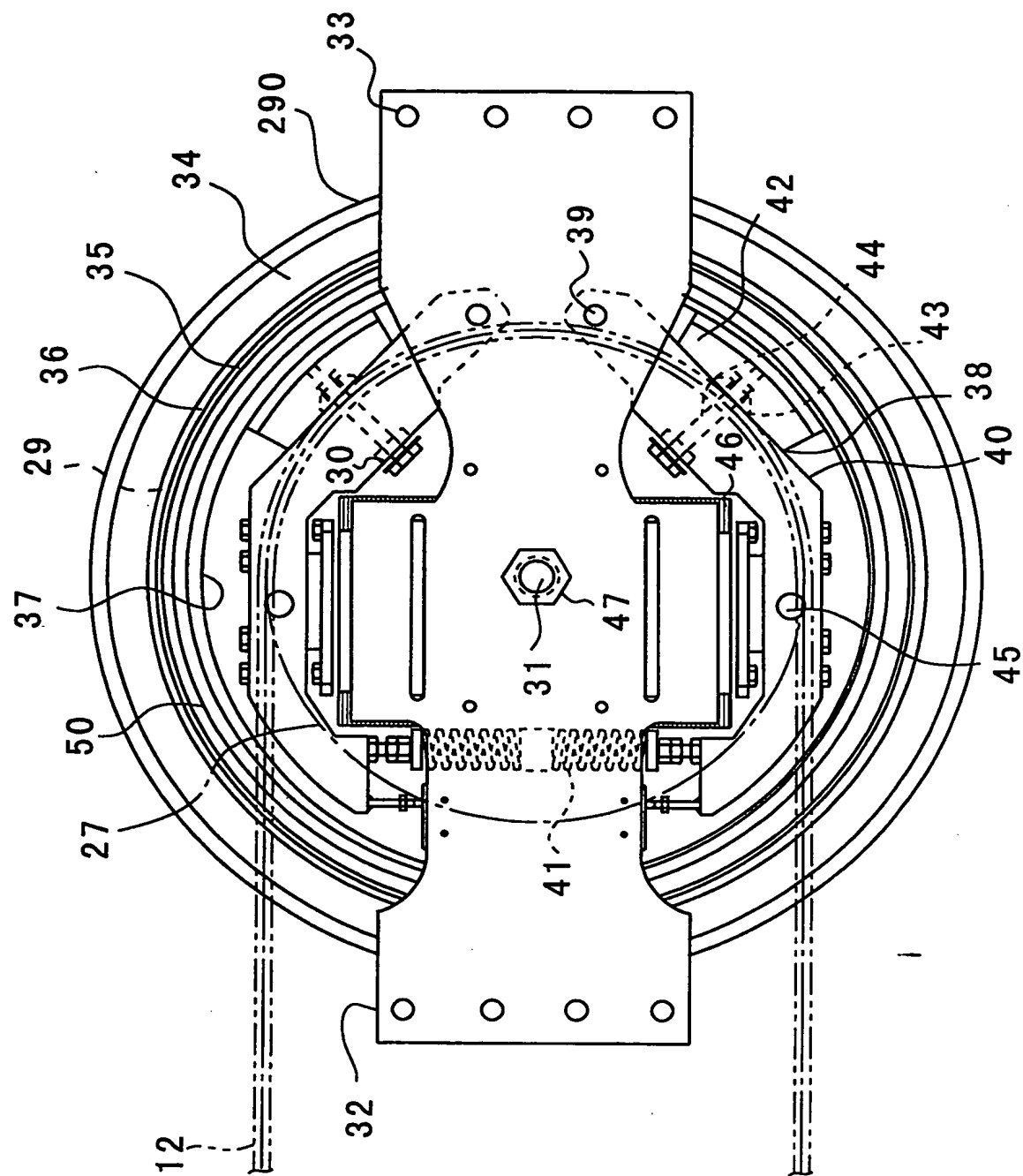
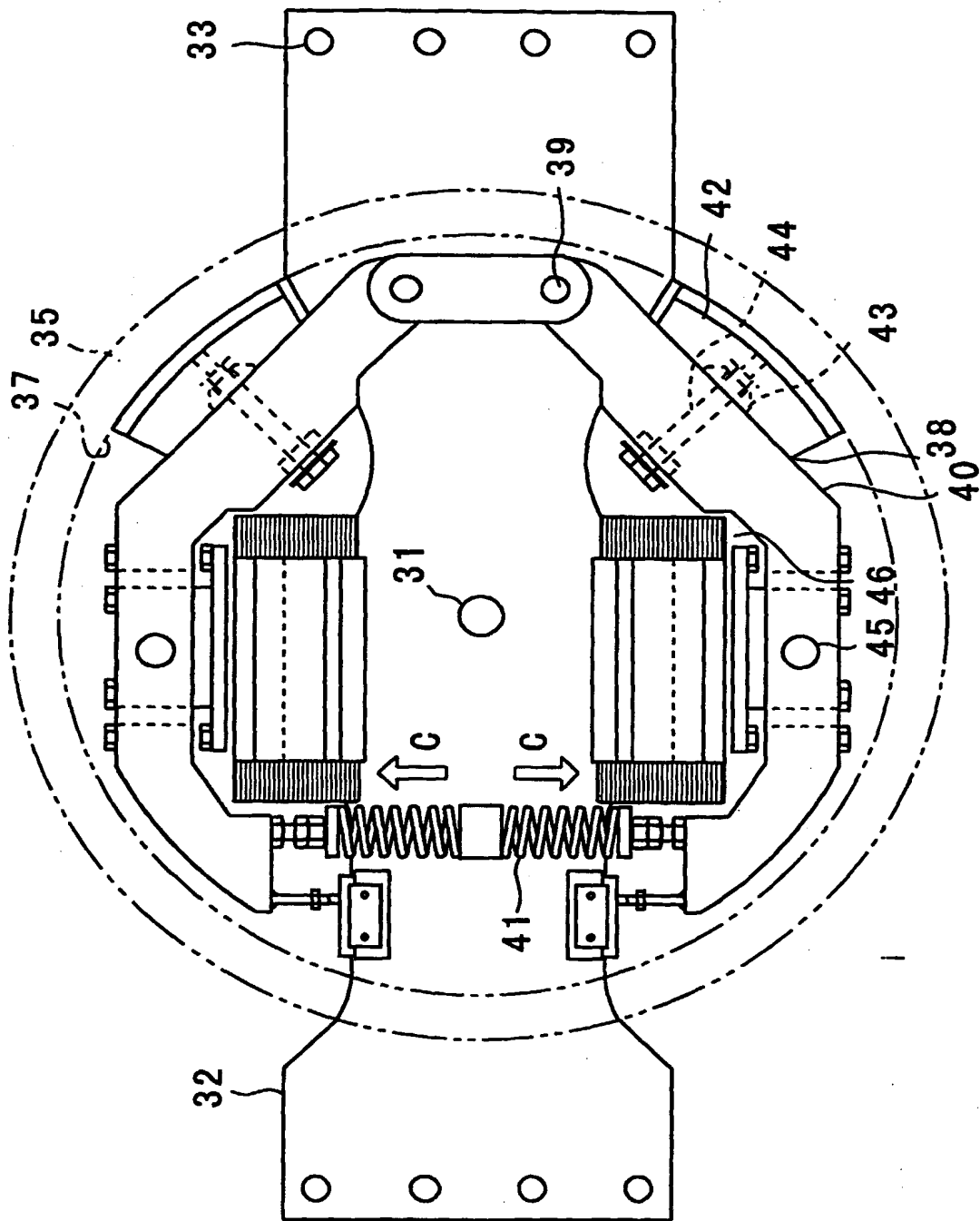


Fig. 6



**Fig. 7**



Fig. 8

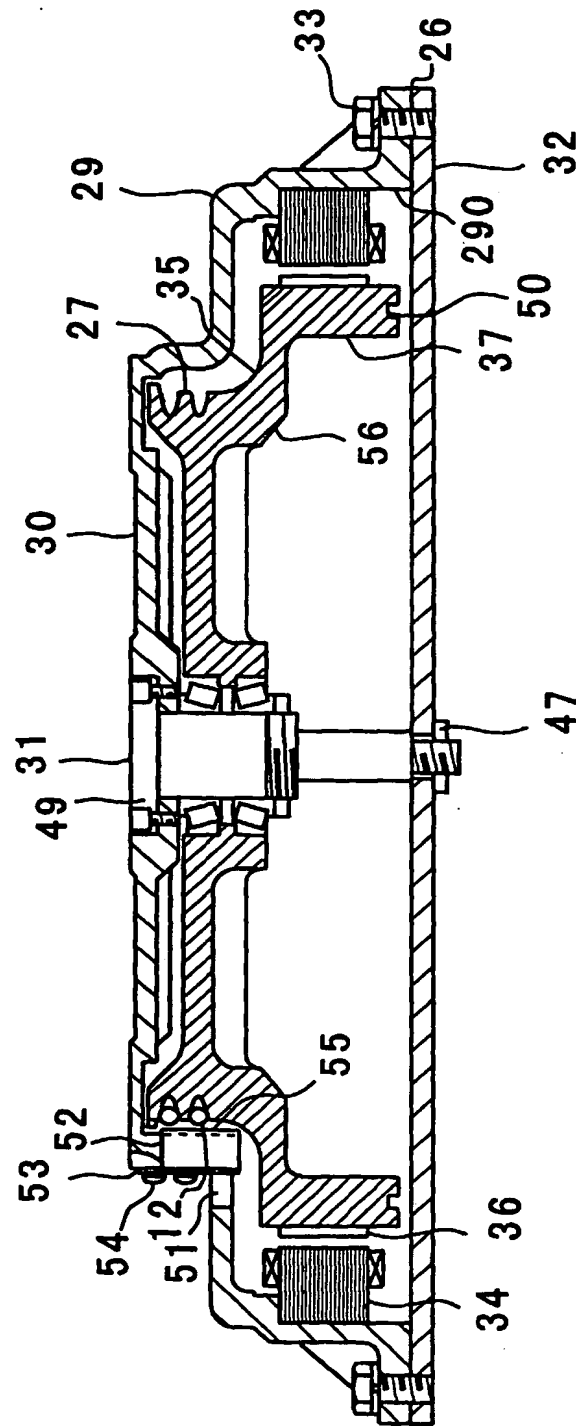
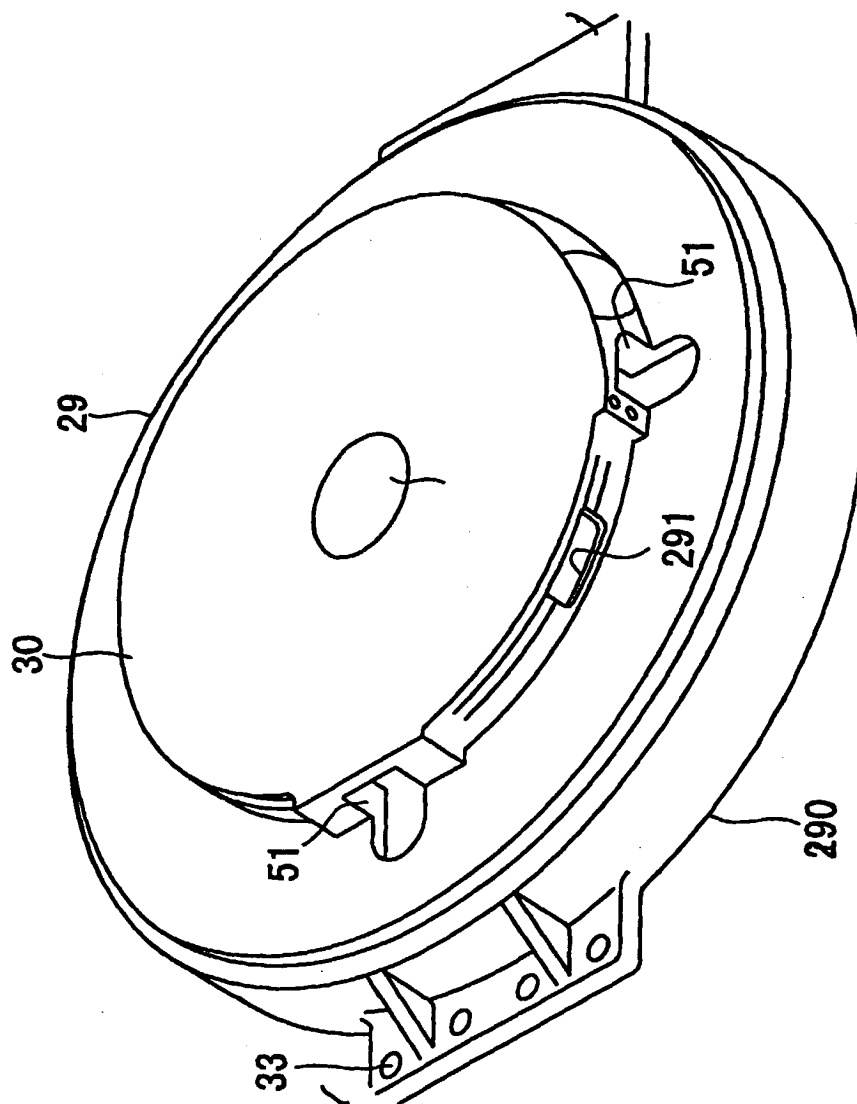
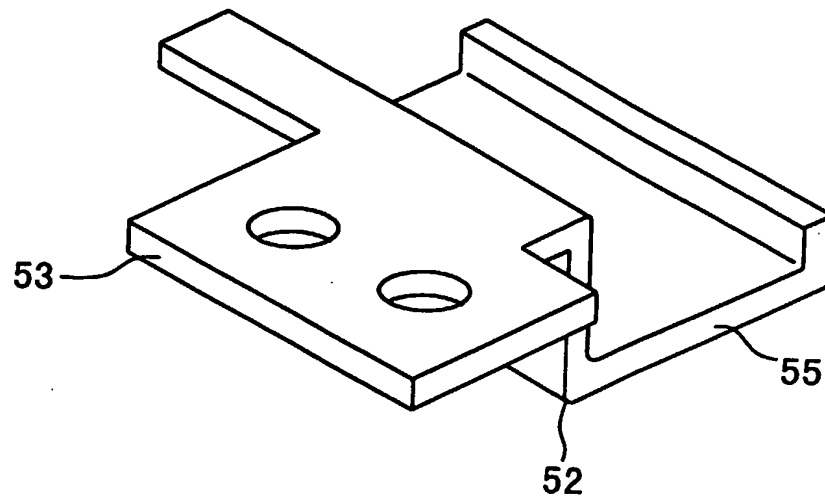


Fig. 9



*Fig. 10*



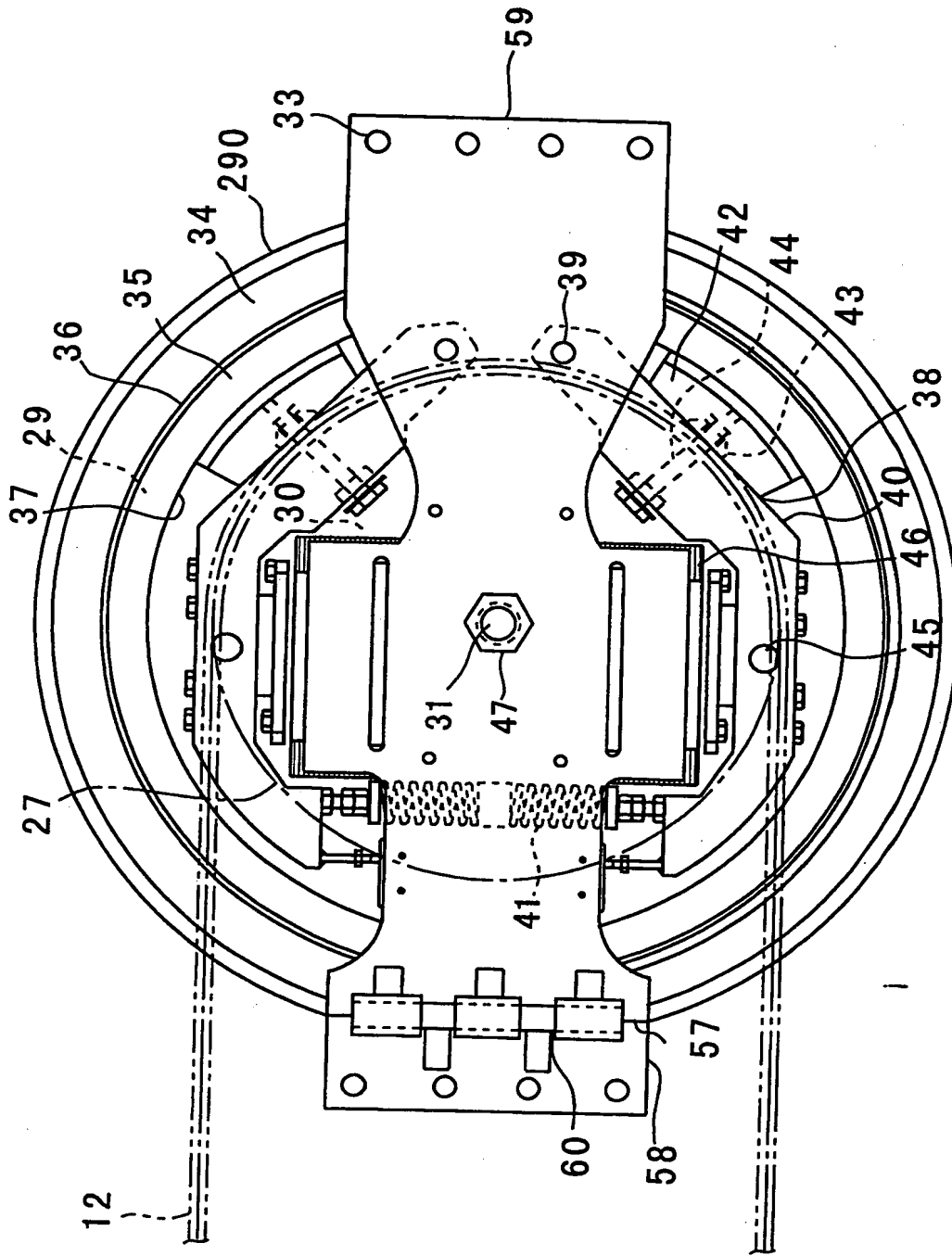


Fig. 11

**Fig. 12**

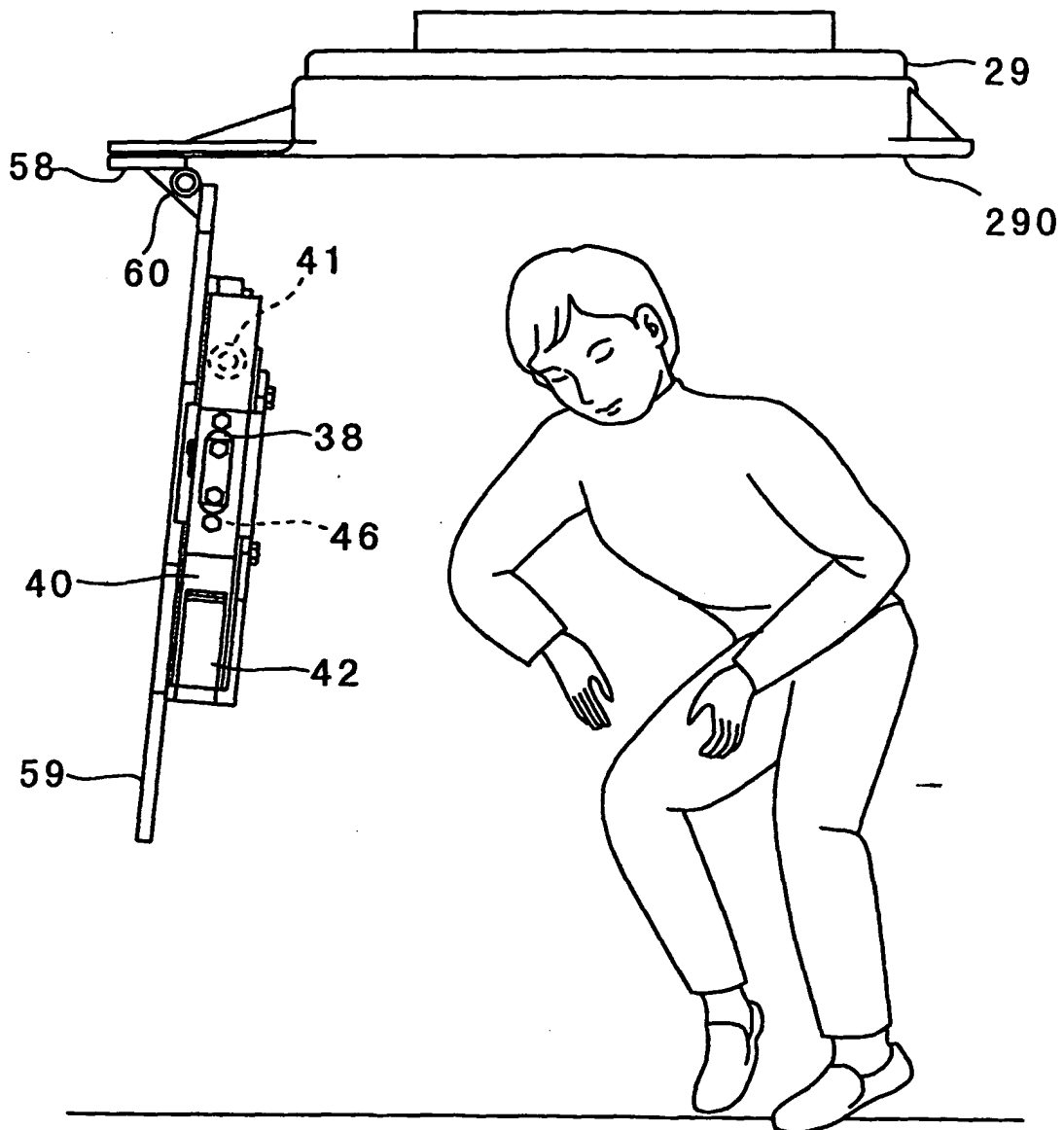


Fig. 13

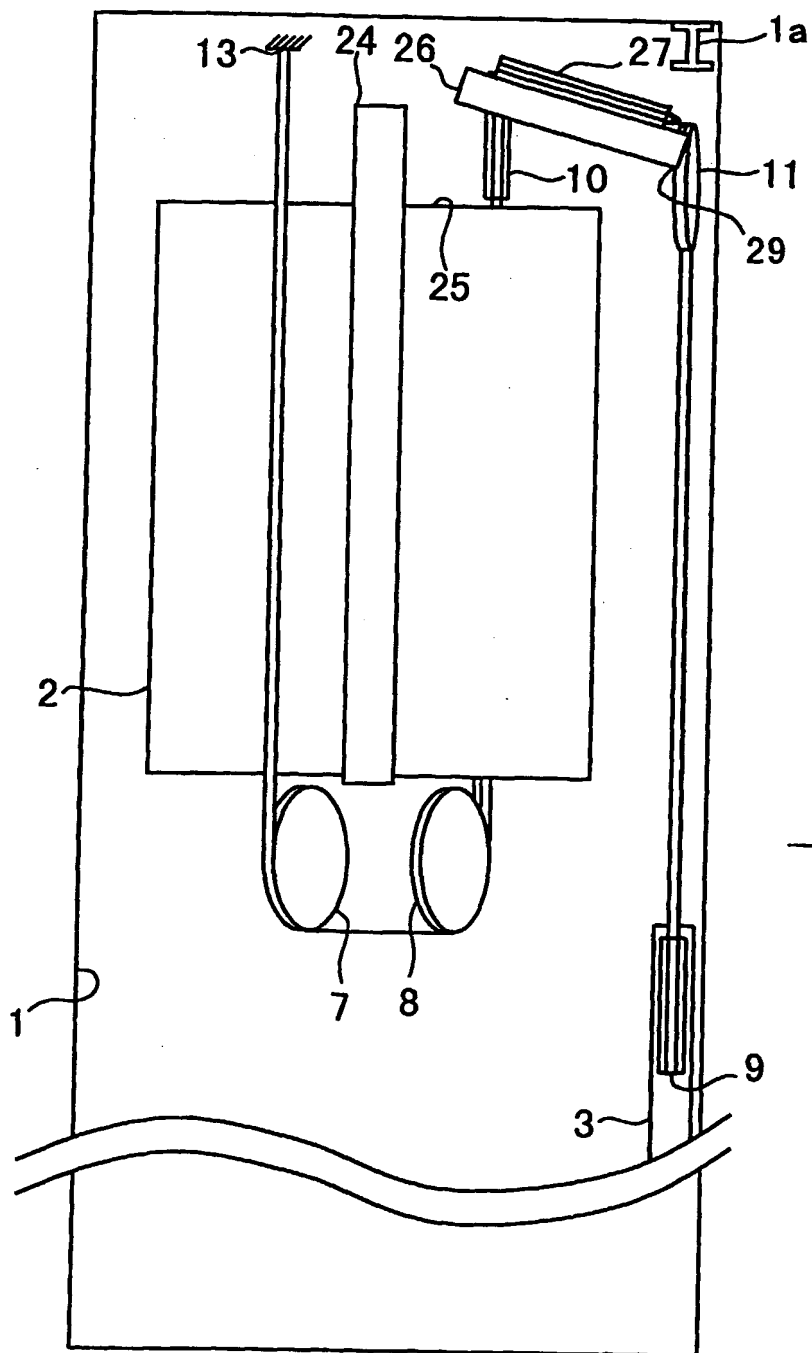
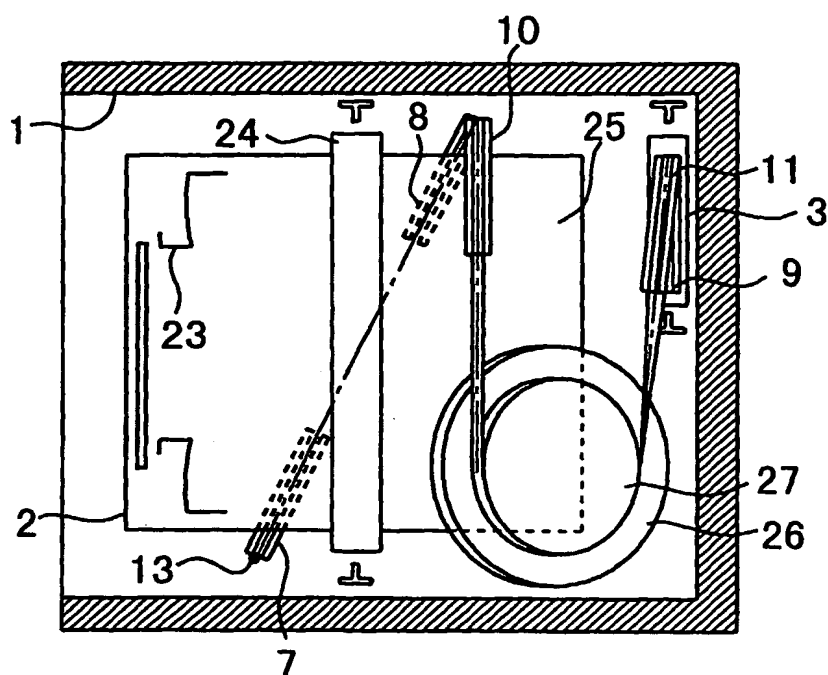


Fig. 14



*Fig. 15*

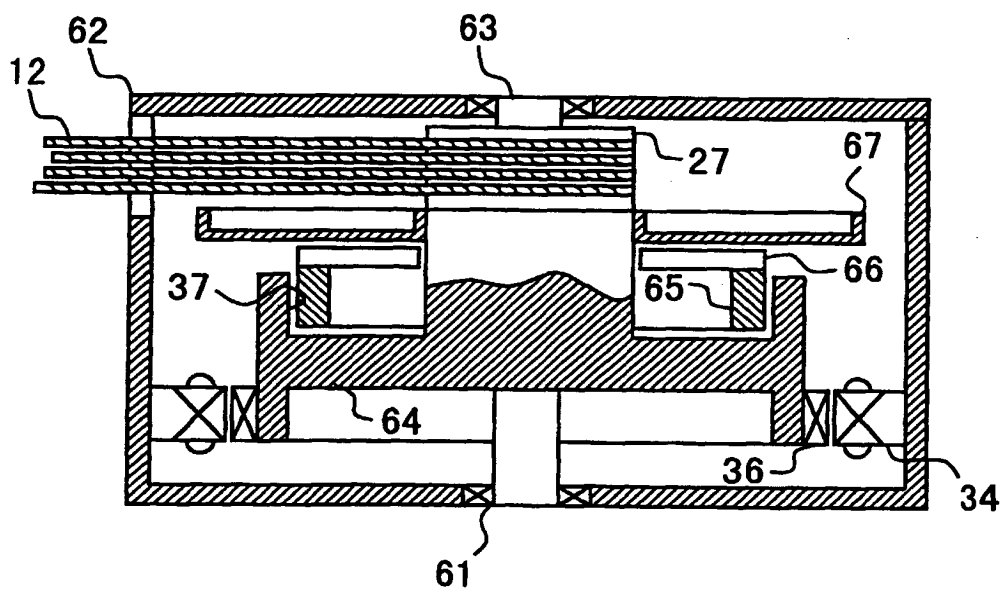




Fig. 16

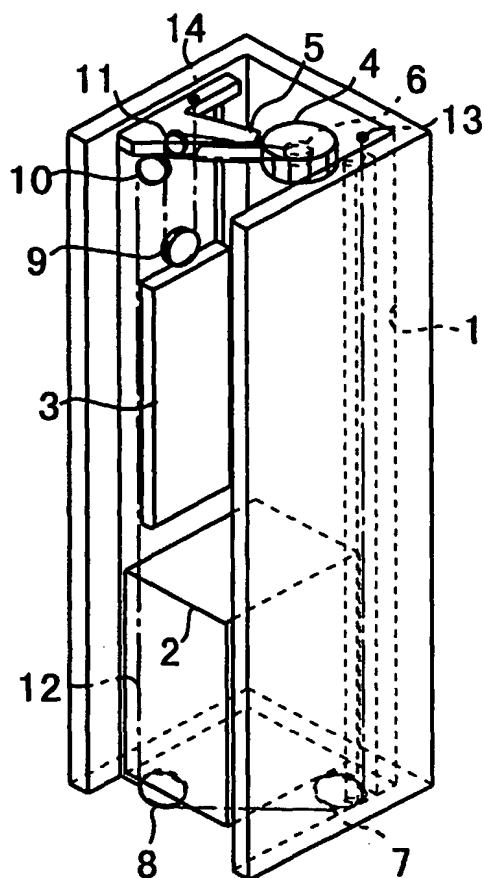


Fig. 17

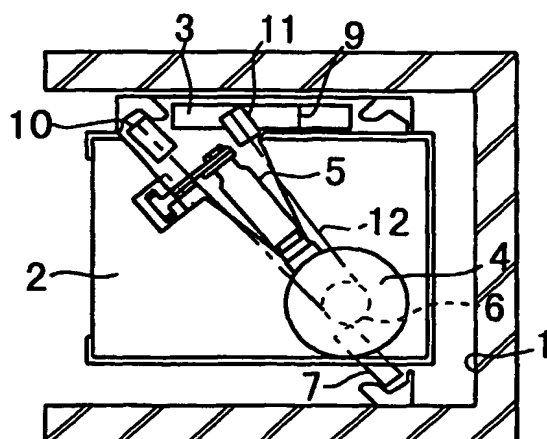


Fig. 18

